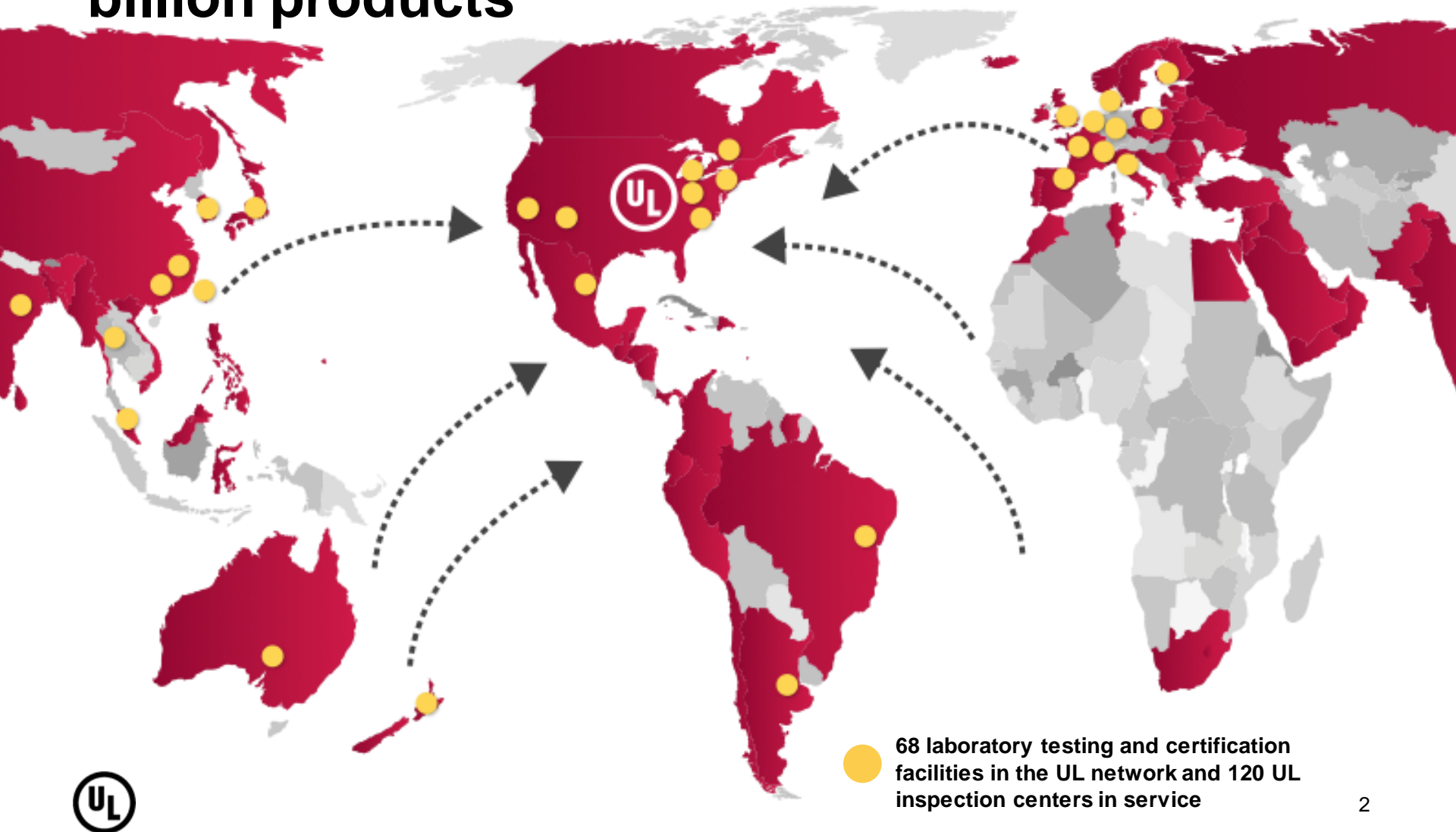


Vehicle Interior Air Quality Testing Program



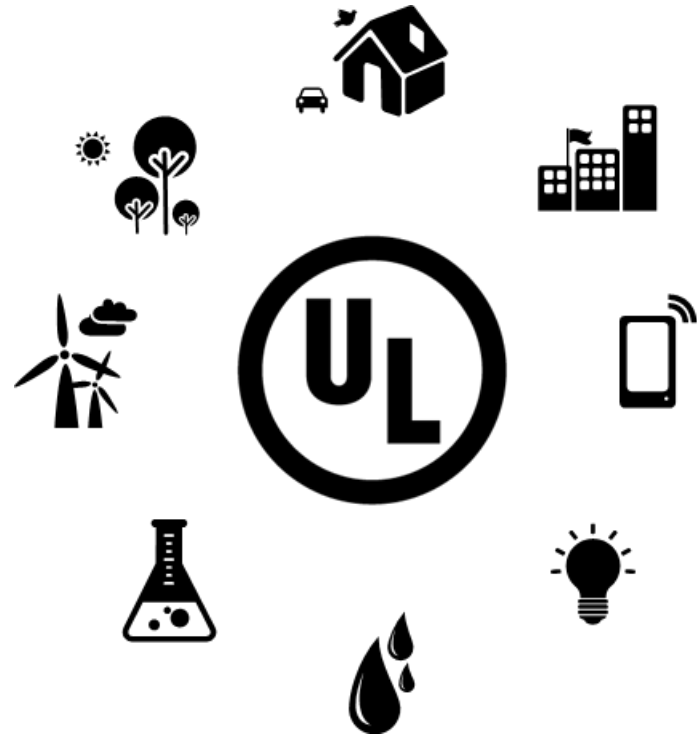
We are the North American market access leader for product safety and our mark is on 23 billion products



The Definition of Safety is Evolving...So is UL

Complex issues of today have replaced concerns of the past. And the safety landscape of tomorrow is yet to be defined.

- Fire Safety
- Indoor Air Quality
- Performance Testing
- Chemical Regulations
- Transaction Security
- Renewable Energy
- Wireless Testing



UL Automotive Team Service



Sections

1. Electric Vehicle Infrastructure Certification
2. Chemical Emissions Testing
3. Environmental Validations and Transparency
4. Responsible Sourcing Solutions
5. Raw Material Traceability

10. EMC/Wireless Global Certification
11. UL Prospector®
12. Material Compliance Management Systems
13. Online Workplace Safety Training
14. Branded Merchandising

5. Knowledge Services Research/Consulting
6. Thermoplastics Testing
7. Ongoing Plastics Quality Testing
8. Automotive Functional Safety
9. EMC/Wireless & Global Market Access



Chemical Emissions Testing

- Over 25 years of product emissions testing experience
- More than 180 large, intermediate and small chambers worldwide – largest global chemical emissions testing capacity of any company
- Laboratory locations in
 - Atlanta, GA, USA
 - Cologne, Germany
 - Kyoto, Japan
 - Nansha, China
- More than 70,000 products tested across the building products, furnishings, electronics, consumer products, and chemicals sectors




VIAQ Background



Vehicle Interior Air Quality Awareness

Early Research

Purchasing Decisions



2001:	2006:	2012:	2015:
BBC News – New car smell linked to cancer	CNN – Don't inhale that new car smell	CBS News – Newcar smell is toxic, study says: Which cars are worst? English.news.cn – Beijing Benz C- class cars could be a health risk: report	International Business Times – US Auto Sales In China: New- Car Smell? No Thanks, Says Chinese Car Buyers

Research Determining Exposure In Cars

- Research studies conducted on used vehicles or vehicles in use (Particulate exposures coming from exterior sources, smoking in vehicles, etc.)
- Few studies exist for measuring Volatile Organic Compounds (VOCs) in new vehicle interiors
- VOCs and other chemicals emitted from interior materials constitute the new car smell
- Chemicals can trigger health effects such as headaches, sore throats, nausea, & drowsiness



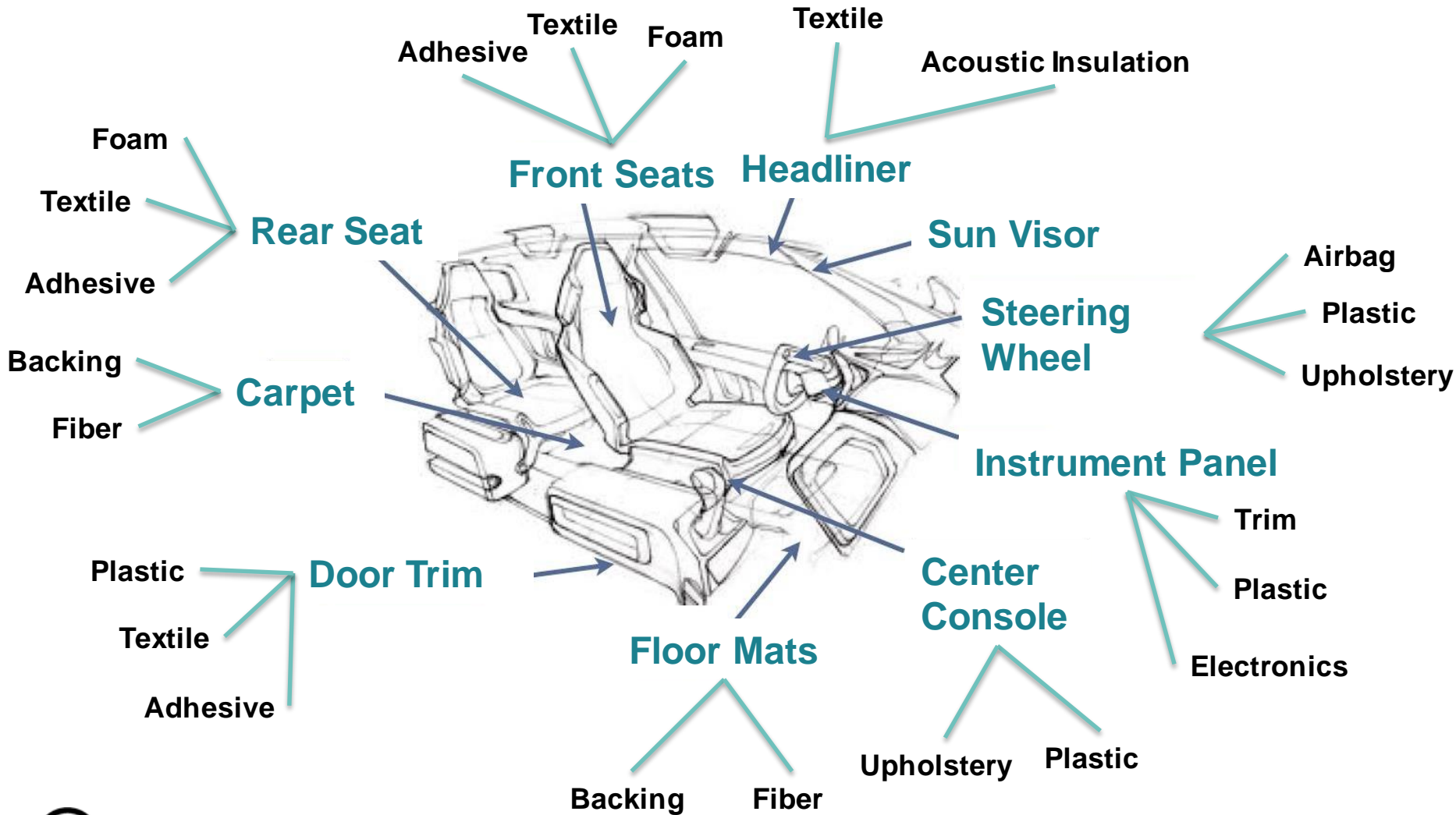
Measurements in Vehicles

*Comparison of Air Pollution by VOCs Inside the Cabins of New Vehicles
(Faber et al, June 2014)*

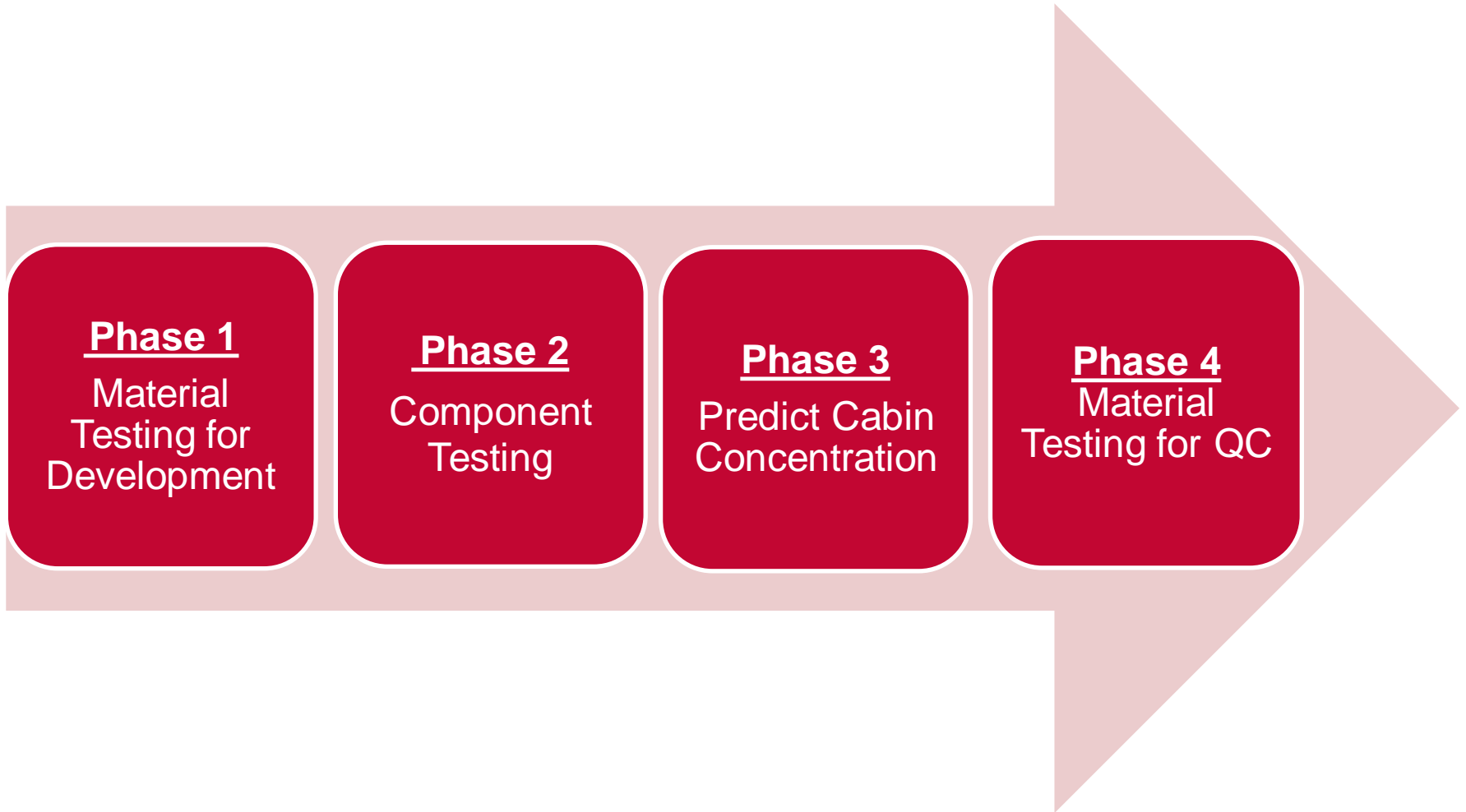
- Total VOC values range from 150 – 14,000 $\mu\text{g}/\text{m}^3$ (Avg. $\sim 2,000 \mu\text{g}/\text{m}^3$)
- Studies in new & used vehicles have found between 30 - >200 VOCs
- Individual VOCs vary depending on interior materials
- Concentration of VOCs observed depends on:
 - Vehicle Interior Temperature
 - Interior Trim Materials
 - Age of Vehicle
 - Ventilation
 - Humidity



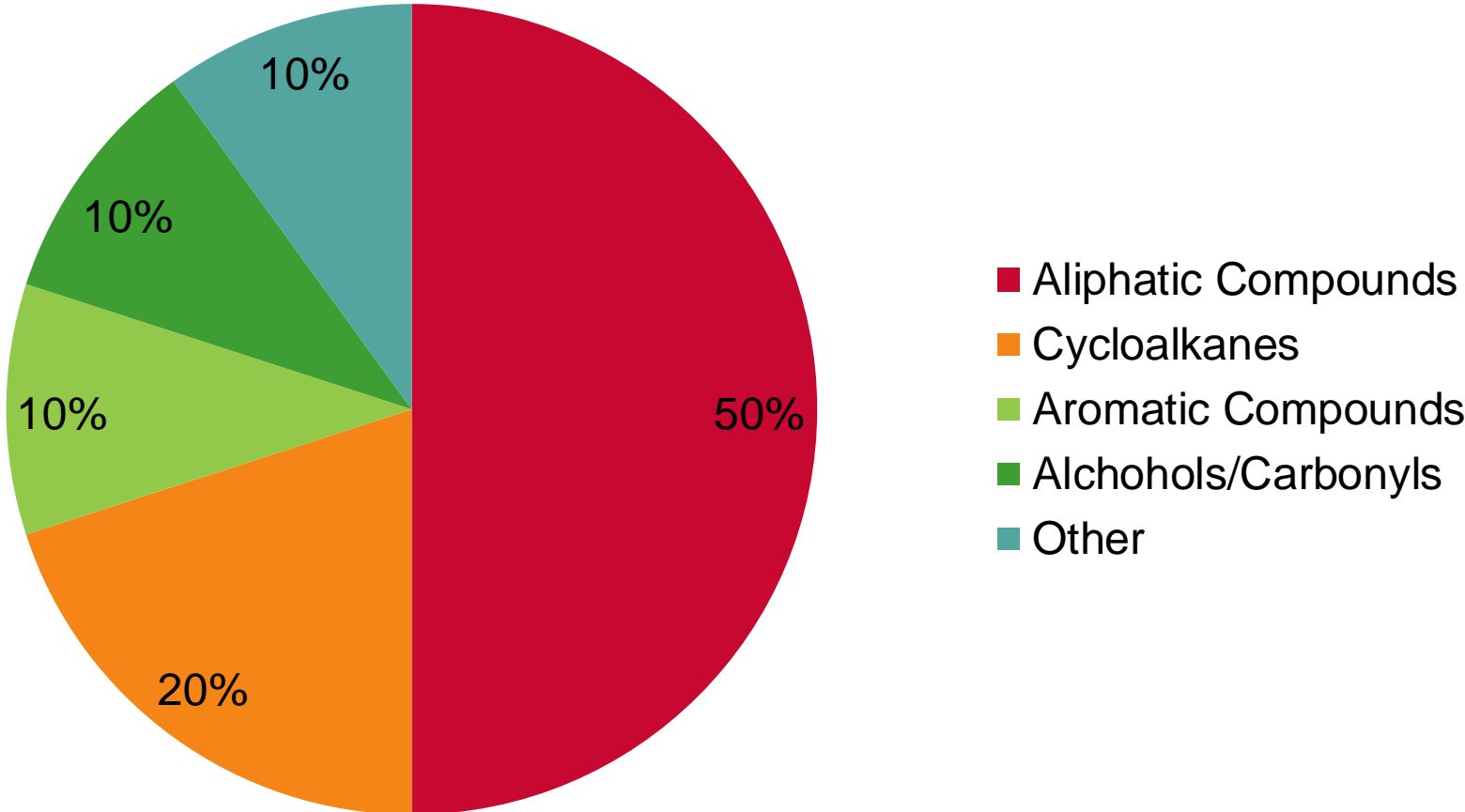
Vehicle Interior Materials & Components



VIAQ Program Development



Classes of VOCs in Vehicle Interiors



Chemicals of Concern

Item	IARC	Effect on Human Body
Formaldehyde	1	Eye, nose, and throat irritation. High levels may cause coughing, wheezing, chest pains, and bronchitis. Lung and nasopharyngeal cancer.
Acetaldehyde	B2	Irritation of the eyes, skin, and respiratory tract. At higher exposure levels, erythema, coughing, pulmonary edema, and necrosis may also occur.
Benzene	1	Causes skin and eye irritation, is extremely dangerous when inhaled, and in serious cases, causes leukemia and increases the occurrence rate of lymph cancer and blood cancer.
Ethyl benzene	2B	Affects internal organs, lungs, central nervous system.
Styrene	2B	Stimulates eyes, skin, nose, respiratory system, causes sleepiness or unconsciousness.
Toluene	3	Stimulates central nervous system, causing nausea, and abnormalities in stomach and nerve system
Xylene	3	Causes nerve stimulation, skin infection, cornea damage and so on, damages kidney and reproductive functions

Group 1 Carcinogenic to humans

Group 2B Possibly carcinogenic to humans

Group 2A Probably carcinogenic to humans

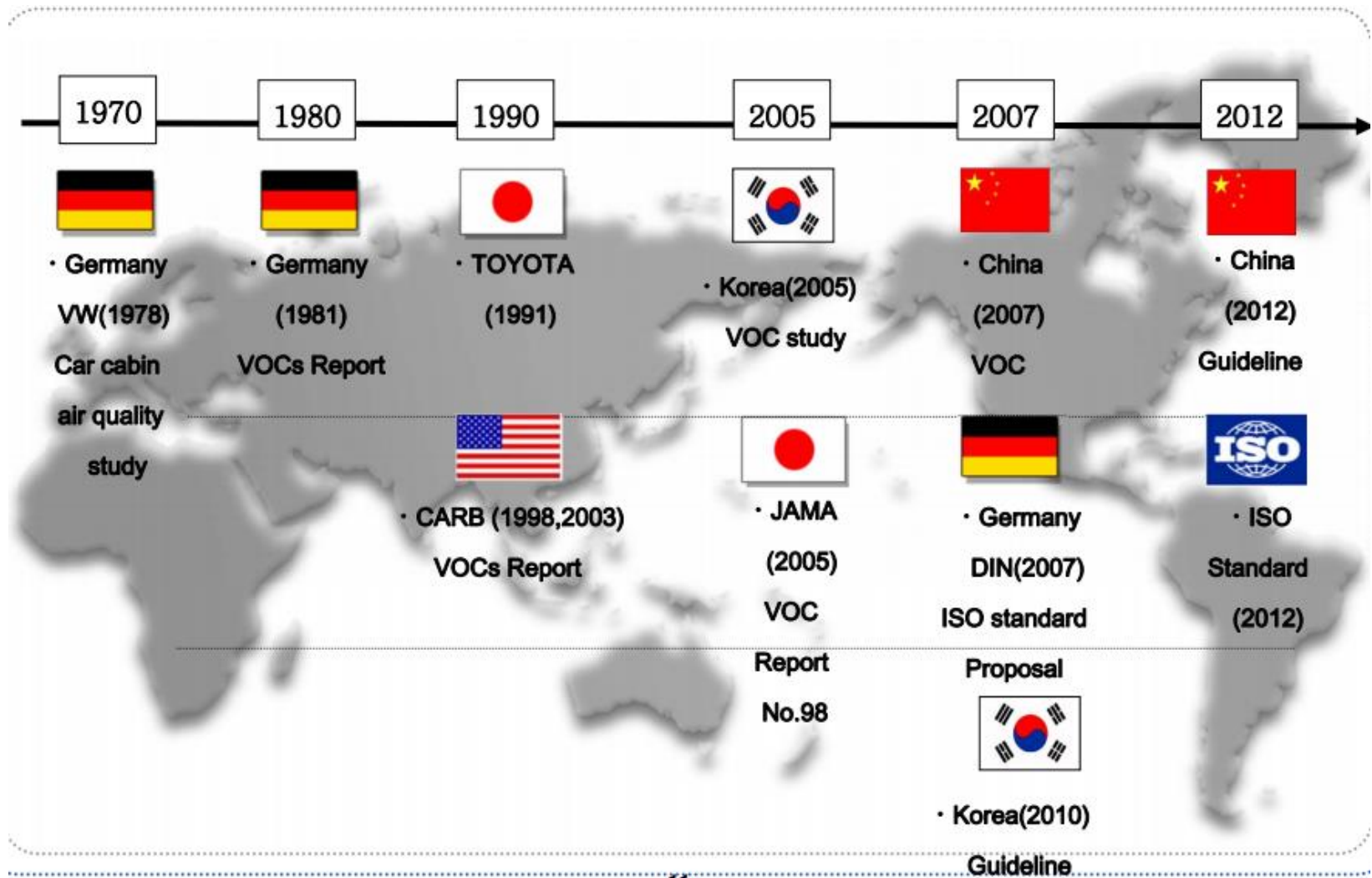
Group 3 Not classifiable as to its carcinogenicity to humans



Global Requirements



Global History of VIAQ Testing



11p

Global VIAQ Requirements



- HJ/T 400-07 December 2007 "Determination of Volatile Organic Compounds and Carbonyl Compounds in Cabins of Vehicles"
- GB/T 27630-2011 01 March 2012 "Guideline for air quality assessment of Passenger car"



- Automobile Management Act Article 33-3, 18 Dec. 2012
- Ministry of Land, Infrastructure and Transportation Notification No. 2007-539, (5 June 2007) "Newly Manufactured Vehicle Indoor Air Quality Management Standard"



- Japanese Automobile Manufacturers Association Guideline "Voluntary Approach to Vehicle Cabin VOC Reduction"
- JASO Z 125 "Road vehicles - Interior - Measurement methods of diffused volatile organic compounds (VOC)"



- ISO 12219-1:2012 "Interior air of road vehicles -- Part 1:Whole vehicle test chamber – Specification and method for the determination of volatile organic compounds in cabin interiors"



Different Approaches for Each Region

USA OEMs

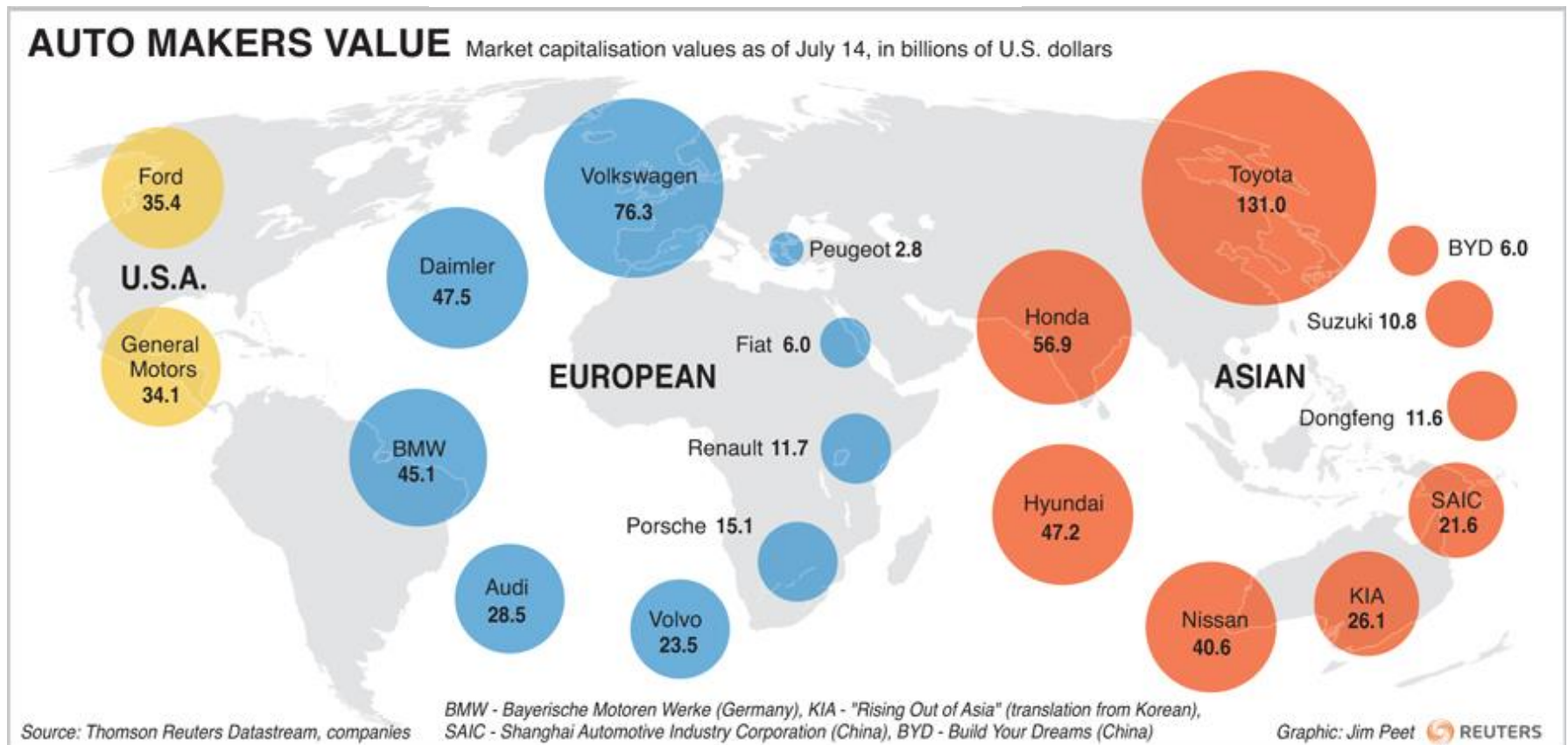
OEM methods
Materials Test

EU OEMs

OEM, ISO, and VDA methods
Component Test (Chamber)
Materials Test

Asian OEMs

OEM and JAMA methods
Component Test (Bag)
Materials Test



ISO Standards

UL testing follows ISO 12219 framework with sufficient flexibility to meet regional and specific OEM requirements

ISO 12219-1:2012 -- Whole vehicle test chamber

ISO 12219-2:2012-- Bag method

ISO 12219-3:2012-- Micro-scale chamber method

ISO 12219-4:2012-- Small chamber method



OEM Standards

Many OEMs have adapted the material and component test standards to meet their individual needs or capabilities.

Chamber Testing

BMW GS 97014-3

VW PV 3942

Renault D49 3027, 3085

Bag Testing

Nissan NES M0402

Toyota TSM 0508G

Honda DWG 0094Z

Mazda MES CF 080 B

Hyundai-Kia MS300-55

Formaldehyde Flask Method

VW PV 3925

Volvo VCS 1027, 2739

Renault D40 3004

GM GMW15635

Headspace

VW PV 3341

Volvo VCA 1027, 2749

Direct Thermal Desorption

Daimler PB VWL 709

Renault D42 3109

GM GMW15634



Questions? Contact UL

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